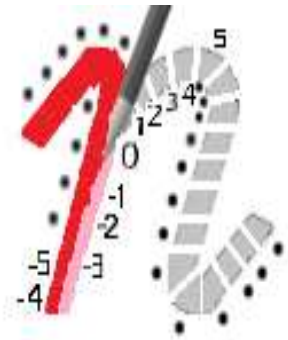
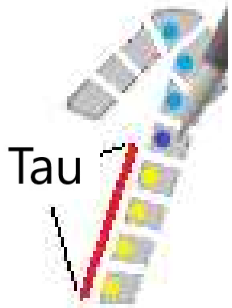
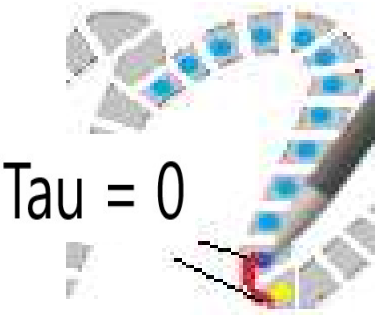
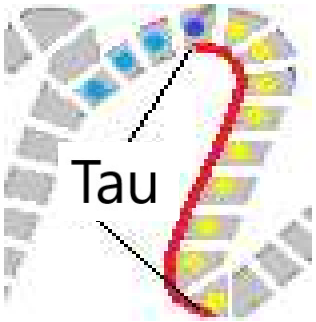
Within writing the essence of the task is solely executed by the external interconnected movements of the pen tip; Within the primary focus the tip of the pen is captured within an action trajectory shape providing several *tau*-values









Caught In A Line
The explanatory model of all motoric movement actions

N.J. Mol

Introduction

Traditionally, science has assumed that one motor action corresponds to one focus. This assumption was likely so intuitive that it was never challenged. However, this has led to the situation where, even after more than 100 years of movement sciences, a plausible explanation for the underlying functional perception processes guiding the execution of all motor actions had never been found.
In contrast, in 2016, an explanatory model emerged that has the capability to identify all functional perception processes within any imaginable motor action. It demonstrates, beyond any reasonable doubt, that each motor action can only be executed through a mandatory coupling of two foci: an internal (secondary) focus that must always be directed towards an external (primary) focus. In which it should be explicitly noted that these two foci represent entities that fundamentally differ from current scientific terminology.
With regard to the external (primary) focus, it can be noted that science has, until now, truly missed everything. Therefore, it is now being explained within a wide spectrum of motor actions, and this publication now reveals all facets of the primary focus within the motoric movement action *writing*. Writing is a unique motoric action because representing the entire action trajectory shape is the essence of the task. Just like in any conceivable action, we create an action trajectory to move the pen tip to the end of a letter, word, or word part, but in writing, the entire action trajectory shape must also become visible. Within this publication, it will become clear that the action trajectory shape within writing also consists of one continuous sequence of positions P of the tip of the pen. This should also serve as evidence that this phenomenon occurs within any conceivable action.

Solely the movements of the tip of the pen encompass the essence of the task c.q. the external (primary) focus

The category of motor actions discussed by the explanatory model pertains the conscious actions where it is assumed that there is always an initial formulation of an egocentric intent (an egocentric formulated will). Before picking up a coffee cup, for instance, there is always the desire to do so. The explanatory model of all motoric movement actions recognizes this as an undisputed factual aspect but

adds a caveat. The egocentrically formulated intent does not, for example, concern picking up the coffee cup itself. The explanatory model reveals that this is factually incorrect and that we can only move our fingertips toward the coffee cup. Therefore, the movement of the fingertips toward the coffee cup constitutes the essence of that action.
In writing, we may indeed aspire to write a brilliant book, but the egocentrically formulated goal solely pertains the movement of the pen tip along an action trajectory shape[1]. Only that aspect defines the essence of the task c.q. the act of writing itself, and therefore, it should be regarded as the external (primary) focus.

The tactical movement action (TMA) within writing

Images: First and foremost an egocentric intention must be formulated that we want to move a pen from a very specific position A to position B along an action trajectory shape. Subsequently, starting from the current position of the pen tip, we create a perceptual image of a latent action trajectory shape between position A and position B (on the left). This occurs as part of a tactical action where two important goals are considered. Firstly, it should lead to a successful action, and secondly, ecologically evolved organisms aim to perform actions as parsimonious as possible. While it might appear that we would not create a perceptual image of a latent action trajectory shape without the delineating lines due to a defined signature box (on the right), because there seemingly are no obstacles, that is categorically incorrect. The tactical consideration does not focus on the lines of a box but solely on the "empty" positions P within an environment where the pen tip can proceed undisturbed. Our visual perception always focuses on positions P where nothing is obstructing, as these positions ensure an unhindered passage of the pen tip.

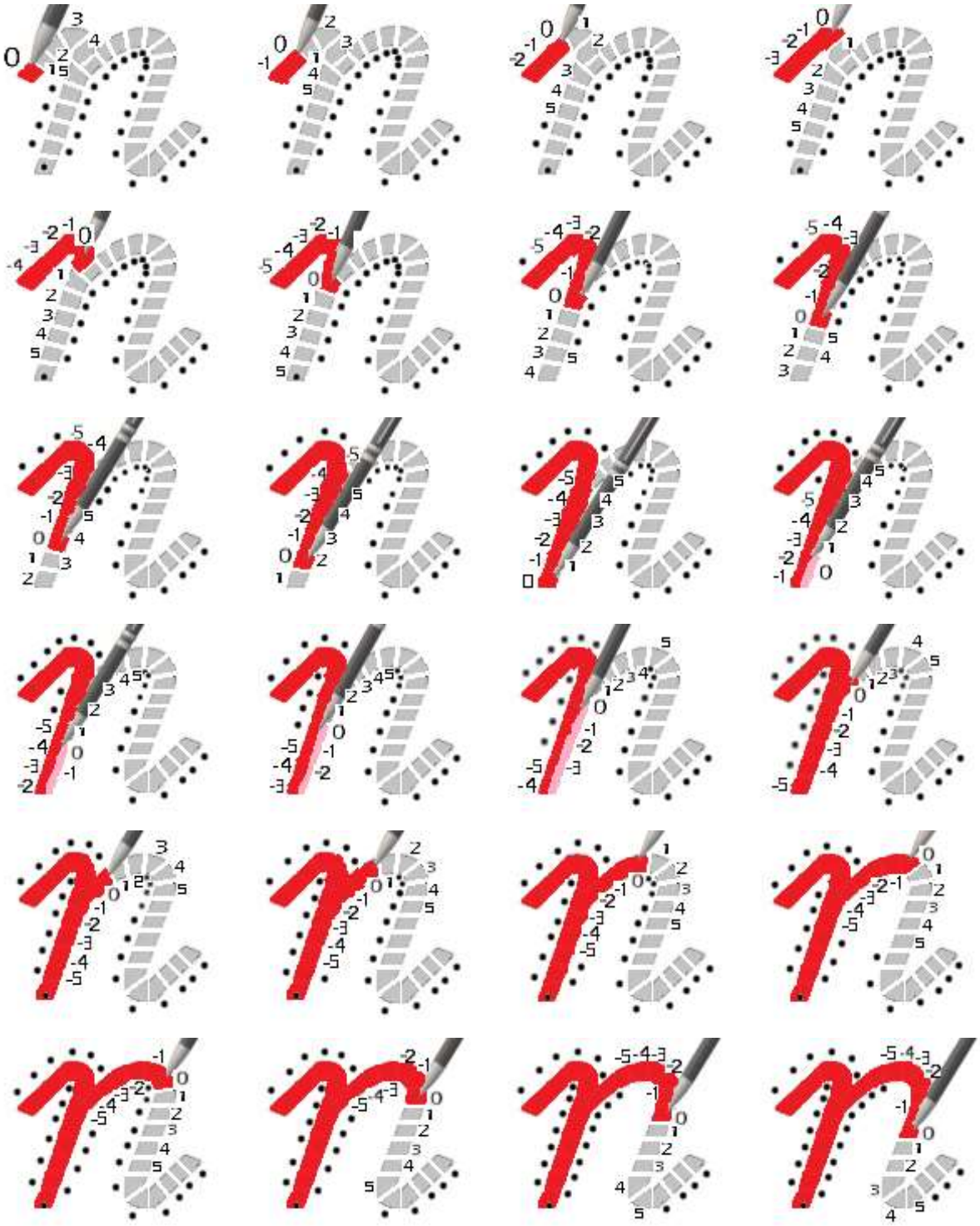
The explanatory model of the motoric movement action indicates that after formulating an egocentrically expressed goal, we always start with a tactical consideration[2] of how to move the action object to the goal location within successive positions P. In the current action, we always create a perceptual image of an action trajectory shape, over which the pen tip can be successfully moved from position A to position B.

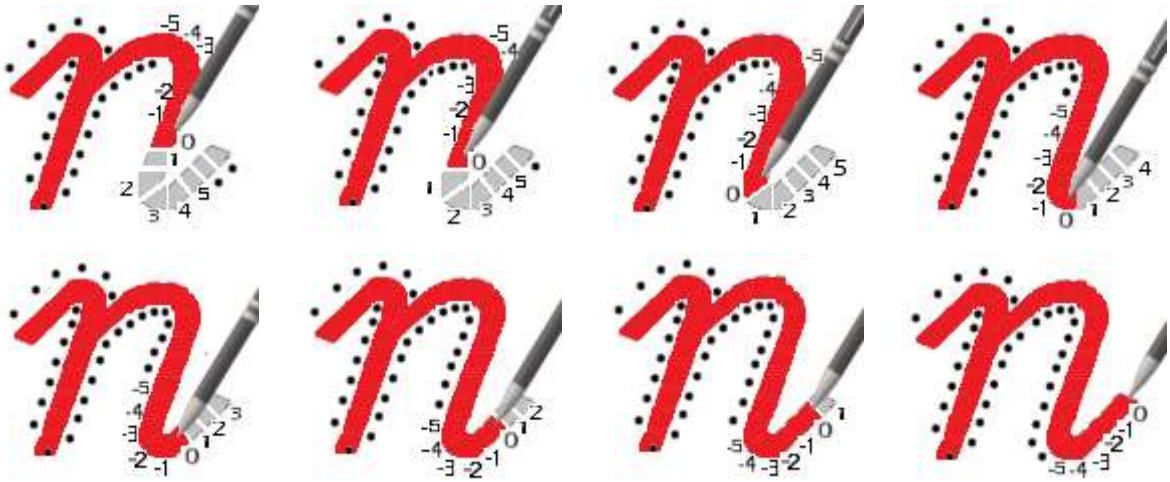
The factual movement action (FMA) within writing the letter “n”

After determining a perceptual image of a latent action trajectory shape, we proceed to actually perform the action. This essentially begins with bridging the current position P(0) of the pen tip to the

[1] Essentially the objective of writing solely compels to depict symbols on a surface to which readers attach the same (cognitive) meaning as intended by the writer.
[2] The scientific evidence has been unequivocally provided for all grasping actions and all throwing actions, and can be easily universally extrapolated to any conceivable action. N.J. Mol; *Grasping encompasses two consecutive autonomous phases – The scientific proof that we tactically construct an action trajectory shape prior to the factual execution of that exact same action trajectory shape.*

next position P(+1) within the action trajectory shape. Although, of course, we ultimately want to reach the end of the letter "n" because there are many more letters to be written, the explanatory model clearly shows in this phase that our perception processes are solely focused on bridging the empty space between the beginning and the end of the letter. So essentially, on a micro-level, only the positions P(-1), P(0), and P(+1) are relevant to us during this bridging phase.





Images: In an animation, the progression within an action trajectory shape can be depicted as follows. Within any conceivable action, the action object (the tip of the pen) can successfully execute the action only by first occupying the next position P(+1) within the action trajectory. The current position P(0) then shifts one step forward, and a manifest position P(-1) is added. This process repeats with every new position P(0) until the end of the action trajectory is reached. Writing is a very special act because the manifest locations P(-x) remain visible. This is in stark contrast to most other motor actions where the manifest locations P of the action line shape disappear. Within writing, it becomes evident that the yet latent positions P(+x) must stem from the manifest positions P(-x). This crucial fact should be extended to all actions where nothing of the action trajectory shape becomes visible.

The perception-action coupling within writing

With the preceding argumentation, the explanatory model of the motoric movement action now provides a comprehensive and universal explanation of how perception is linked to the action within any conceivable task. The animations in the previous section illustrate that the tip of the pen c.q. the action object maintains a fixed relationship with the perceptual image of the action trajectory shape. This becomes easier to comprehend when envisioning a marble in a marble run. In this analogy, you will become much more aware that the perception-action coupling is one unified c.q. one complete phenomenon where only a single change occurs every ongoing time span. Within the marble run it becomes quite visible that during the actual execution, each position P(0) serves as the precise separation between all already manifested positions P(-x) and the latent positions P(+x) yet to be traversed.
Through this explanation of the perception-action coupling, the explanatory model can precisely demonstrate how organisms must have evolved within an ecological framework. However, delving into this subject exceeds the scope of this publication. Only a single remark will be dedicated as it is relevant in regard to the functional perception processes within this motor action.
It should be noted that the action of the pen tip can be clearly observed, but no fixed unit of time can be attributed to it. Each unit of time can be subdivided into 1000 smaller time units, and these time units, in turn, can be further divided. This argument suggests that the action essentially occurs within such a brief moment of time that it only gains meaning in relation to observations within adjacent time units. In other words, the perception of the current position of the pen tip only acquires meaning through the adjacent future "actual" positions P(+x) and the adjacent manifest "actual" positions P(-x) of the pen's tip. The main idea here is to illustrate that observations within any conceivable action primarily pertain to a single phenomenon in which the perception of the action also generates a perceptual image, but most importantly, they are entirely interdependent and cannot exist without each other.

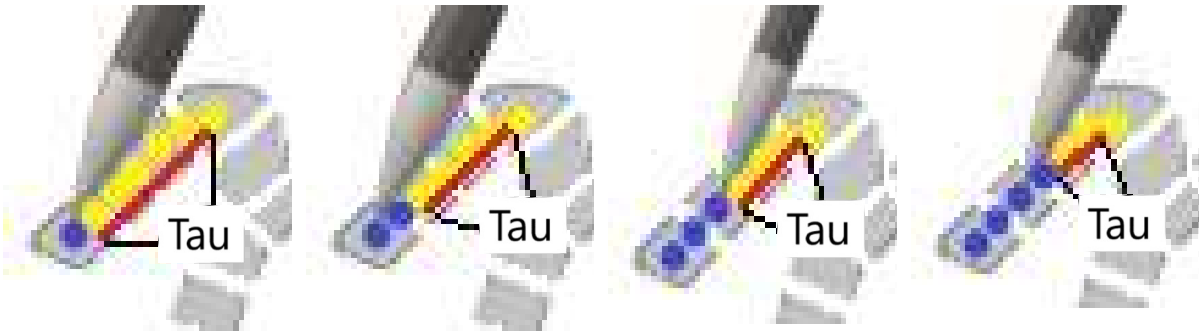
Images: Within many motoric actions the action trajectory shape will not become visible, making it challenging to depict with animations. Writing makes it somewhat easier because the manifest part remains visible. However, the perceptual image of the latent part remains invisible. Conversely, the marble within the marble run, is capable to vividly illustrate this concept. It clearly showcases one single phenomenon wherein the marble, at each position P, delineates the precise separation between all already manifested positions P(-x) and all latent positions P(+x). Additionally, it exemplifies one of the essences of the (perception-action) coupling. If there were no marble run to see, the movements of the marble would lack a framework, and conversely, if there were no marble to see, we could not perceive the coupling either. Without each other, they have no meaning whatsoever.

The *tau*-values in writing the letter "n"

The explanatory model of the motoric movement action, as demonstrated by the perception-action coupling, shows that the perception of each position of the pen tip c.q. the action object within the action trajectory shape is equally important. Which especially becomes apparent in the case of writing. In the vast majority of motor actions, the ultimate objective is to reach the end of the action trajectory shape. Then the task c.q. the egocentrically formulated intent will be finalized. When that happens, the entire latent action trajectory shape will be filled with manifest locations P and no more latent positions P will be left. Within his *tau*-coupling theory, D.N. Lee referred to this phenomenon as the *tau*-value approaching to zero.
In writing, this ultimately occurs as well when we reach the end of a letter, word, or word part. However, because making the entire action trajectory shape manifest is the essence of writing, the entire writing action is essentially a continuous *tau*-coupling. A detailed explanation of this is omitted here, and we will suffice by mentioning five distinct *tau*-values that arise solely when writing the letter "n".

Tau-value 1

Within the perception-action coupling, the tip of the pen will traverse all latent positions P that have been strategically determined beforehand within a perceptual image of an action trajectory shape. With each successive position P of the pen tip, the *tau*-value will decrease



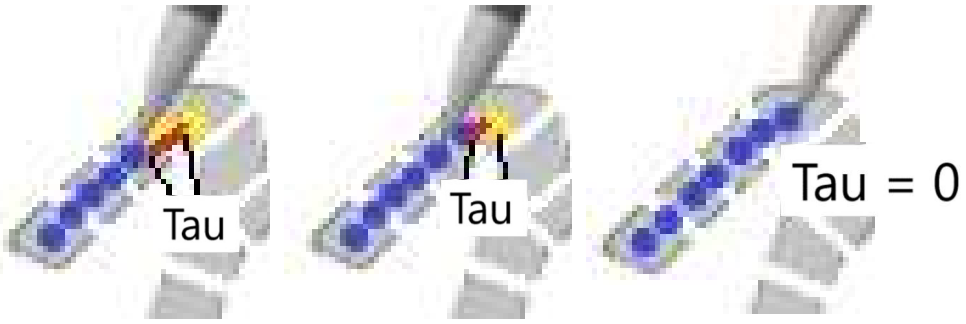
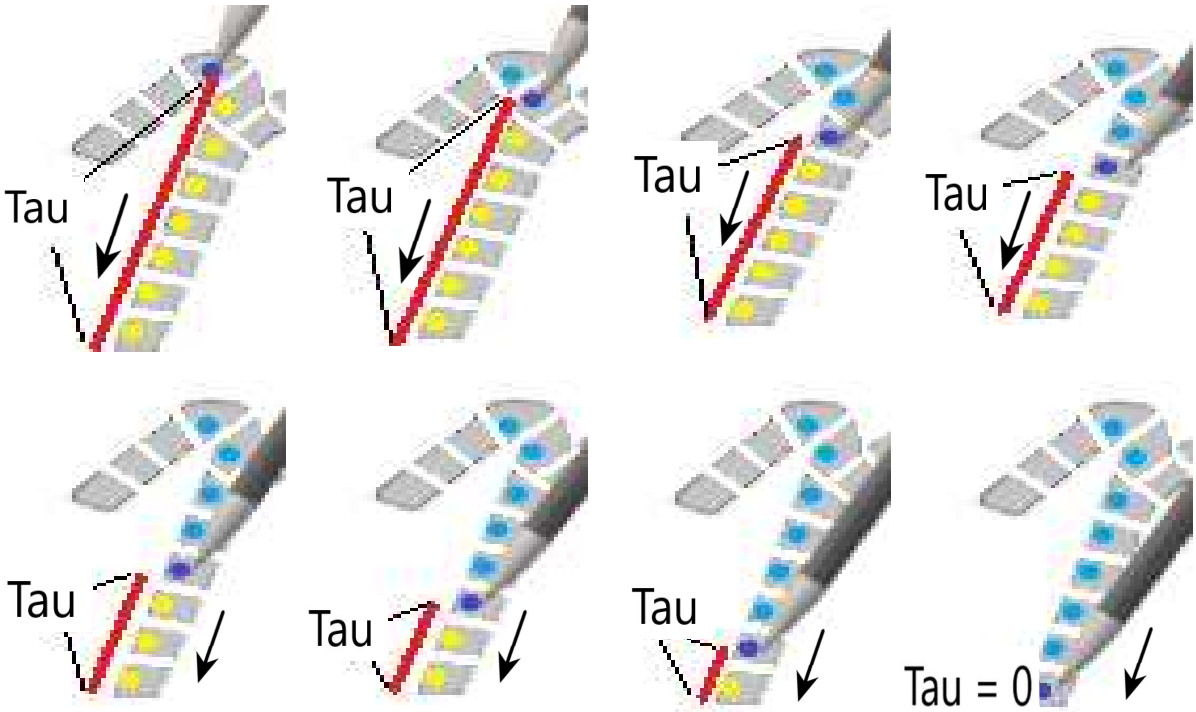


Image: From the beginning of the letter "n", you must perceive the first *tau*-value in the ascending line segment shape, approaching zero for the first time as you reach the curve. The ascending movement of the pen tip must then, within the curve, transition precisely in time to the descending movement of the pen tip. The *tau*-value can be perceived in two autonomous ways. You can observe how the manifest locations P of the pen tip take over the latent action trajectory shape[3], or you can observe at an even more fundamental level at what speed the latent part of the action trajectory shape disappears. Which means that you only need to perceive how the latent "*gap*" is closing.

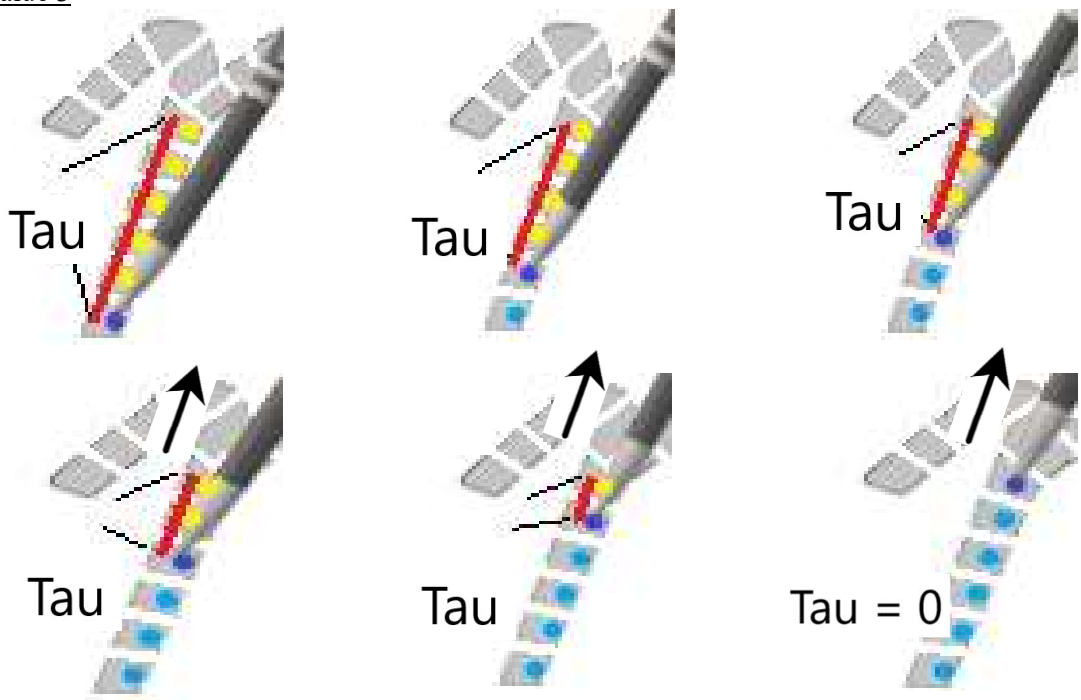
Tau-value 2



Images: From the first curve to the end of the first leg of the letter "n", you must perceive a *tau*-value approaching zero for the second time. This pertains to the long downward line when creating the first leg of the letter "n". At the bottom of the leg, the descending movement of the pen tip must be precisely and completely halted in time, and the pen tip must initiate the mirrored return journey to the third *tau*-value. The *tau*-value can be perceived in two autonomous ways. You can observe how the manifest locations P of the pen tip take over the latent action trajectory shape[4], or you can observe at an even more fundamental level at what speed the latent part of the action trajectory shape disappears. Which means that you only need to perceive how the latent "*gap*" is closing.

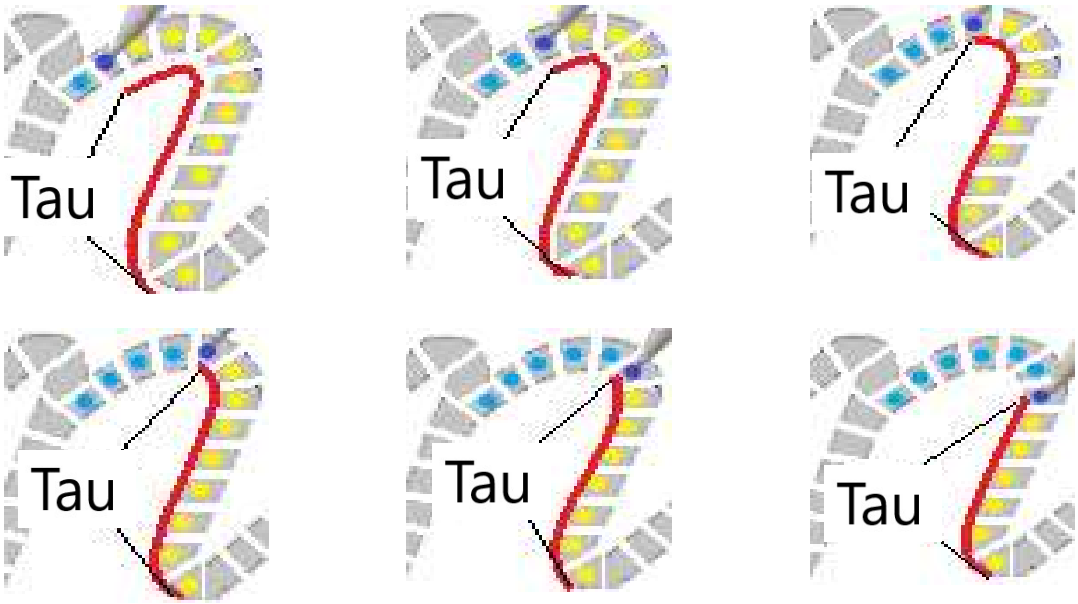
[3] Yellow dots and red line.
[4] Yellow dots and red line.

Tau-value 3

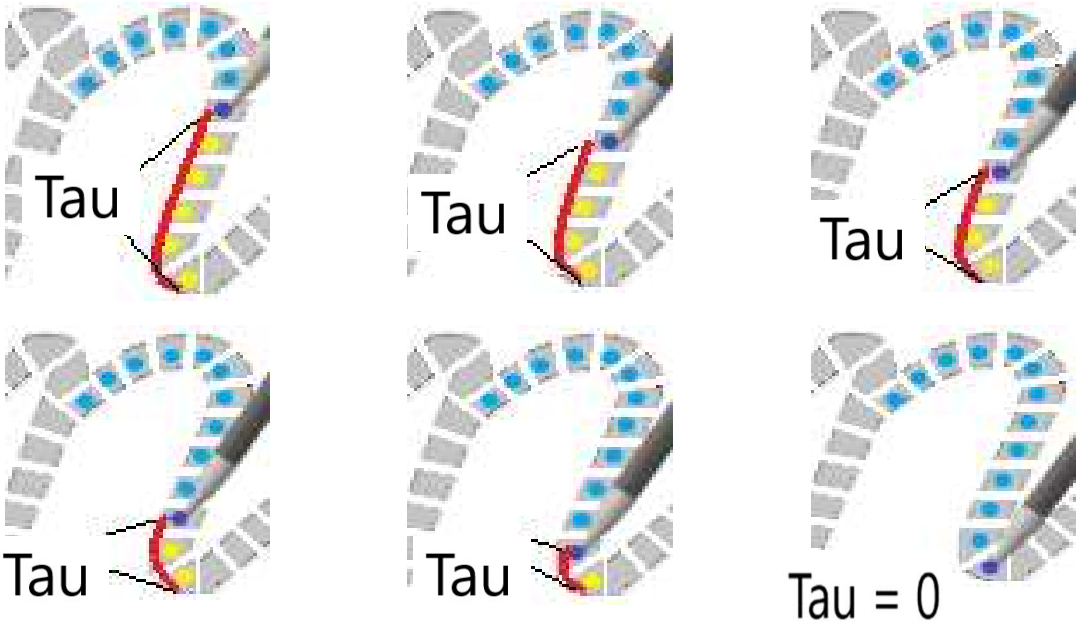


Images: T ourney back upward determin e third time when you must pe ve a *tau*-value and watch it oach zero. At the precise mon when you observe that the act osition P(0) of the pen tip re ies the initial height of the begi g of the letter "n", you must n the pen tip curve towards the connecting arc with the second leg. The *tau*-value can be perceived in two autonomous ways. You can observe how the manifest locations P of the pen tip take over the latent action trajectory shape[5], or you can observe at an even more fundamental level at what speed the latent part of the action trajectory shape disappears. Which means that you only need to perceive how the latent "*gap*" is closing.

Tau-value 4

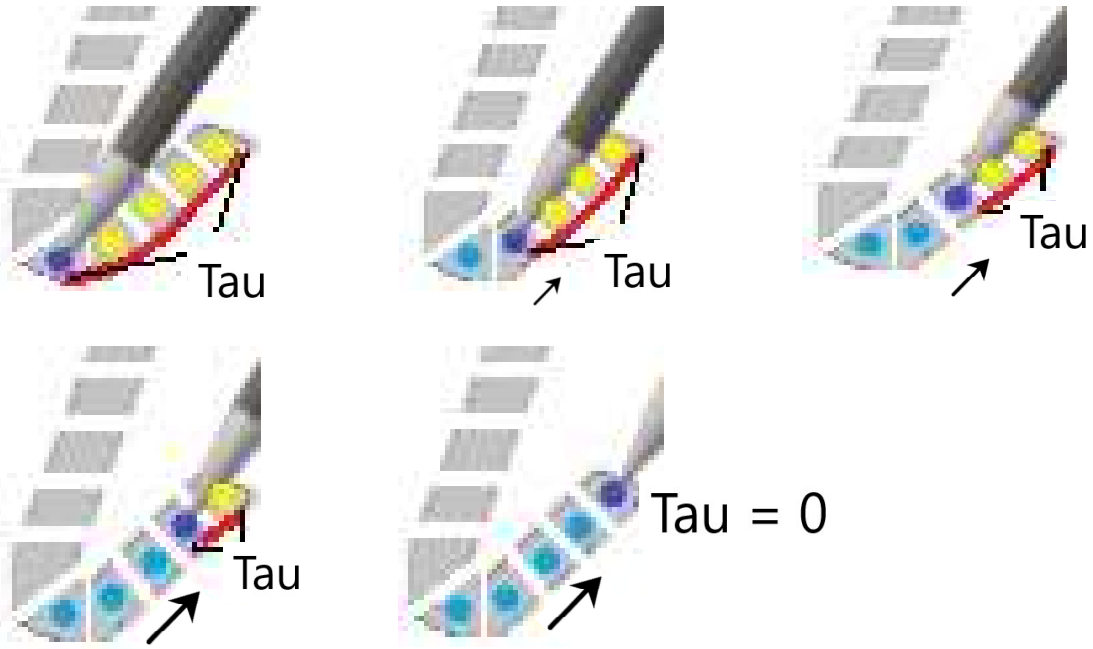


[5] Yellow dots and red line.



Images: The connecting arc to the end of the second leg of the letter "n" determines the fourth time when you must perceive a *tau*-value and watch it approach zero. At the precise moment when you observe that the actual position of the pen tip aligns with the end of the first leg (of the letter "n"), the action trajectory shape must be bent in such a way that the end of the letter can be initiated. This involves a reverse curve that is the subject within the first *tau*-value. The *tau*-value can be perceived in two autonomous ways. You can observe how the manifest locations P of the pen tip take over the latent action trajectory shape[6], or you can observe at an even more fundamental level at what speed the latent part of the action trajectory shape disappears. Which means that you only need to perceive how the latent "*gap*" is closing.

Tau-value 5



[6] Yellow dots and red line.

Images: Reaching the end of the second leg, within the perception of the fourth *tau*-value, to the end of the letter "n" determines the fifth time when you must perceive a *tau*-value and watch it approach zero. When you observe that the current position of the pen tip is nearing the end of the letter "n", the pen tip must be decelerated and precisely removed from the paper at the right moment. The *tau*-value can be perceived in two autonomous ways. You can observe how the manifest locations P of the pen tip take over the latent action trajectory shape[7], or you can observe at an even more fundamental level at what speed the latent part of the action trajectory shape disappears. Which means that you only need to perceive how the latent "*gap*" is closing.

[7] Yellow dots and red line.